PATENT SPECIFICATION 672,102

Date of Application and filing Complete Specification: June 2, 1950.

No. 13891/50.

Application made in France on Feb. 9, 1950.

Complete Specification Published: May 14, 1952.

Index at acceptance:—Class 80(ii), C1d.

COMPLETE SPECIFICATION

Stepped Pinion Freewheel

We, SOCIÉTÉ BOURRIN FRÈRES, a French body corporate, of 14, Rue Basse des Rives, Saint Etienne, Loire, France, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

In known freewheels provided with stepped pinions showing considerable differences in diameter, the rotation of the pinions over the freewheel core is generally performed through the agency of two rows of balls or of two bearings fitted between same. Although this arrangement appears as perfectly rational, said arrangement is, however, not without drawbacks inasmuch as it is practically impossible to obtain two perfectly concentric ball bearings, which leads to an uneven distribution of the stresses supported and of the wear and furthermore, the mounting of the two ball bearings is costly, the dismantling not very easy by reason of the easy dispersion of the balls and the driving stress exerted by the chain often produces a flexion of the ball bearings that is very objectionable for proper operation.

In order to remove these drawbacks, we have designed the freewheel forming the object of the present specification and to this end said freewheel cooperates with a ball bearing and a smooth bearing surface to allow its rotation over a core with a slight clearance between it and the smooth bearing surface provided on one end of said core while it is centrally and revolubly supported by a ball bearing carried by the other end of the core that is of a reduced diameter, the usual spring, catch and toothed arrangement connecting the free wheel body with the core to ensure their synchronous rotation in the direction of driving.

With a view to suitably defining the object of the invention without, however, limiting it thereby, we have illustrated in accompanying drawings an embodiment thereof.

Fig. 1 shows the freewheel body on which are mounted the stepped pinions.

Fig. 2 is a diametrical section of the body shown in Fig. 1.

Fig. 3 is a view from above of an actual core that is to carry the freewheel.

Fig. 4 is a front view of the core shown in Fig. 3.

Fig. 5 is a diametrical cross-section on a larger scale of the freewheel and associated core, the dot-and-dash lines showing part of the hub.

Figs. 6 and 7 are diagrammatic views showing with some amplification the clearance between the freewheel and the pinion system on one hand and the core on the other, to allow compensation for the inclination of the chain engaging either outer pinion.

The freewheel system according to the invention includes a core *a* that is recessed inwardly and tapped in order to be screwed over the hub *b* (drawn in dot-and-dash lines in Fig. 5).

In order to allow for the large differences in diameter of the freewheel pinions, the core *a* is provided with a front bearing portion *a*1 the diameter of which is reduced with reference to the main portion *a*2 beyond which is formed a narrow bearing flange *a*3 of a larger diameter (Figs. 3 and 4).

The freewheel body *c* (Figs. 1 and 2) is rigid with the pinion *d* and is provided with a cylindrical part *c*1 of a larger diameter over which are screwed the pinions *e* and *f*. The body *c* includes also a part *c*2 of a reduced diameter on which is screwed the small diameter pinion *g*. Inwardly, the part *c*2 is provided with a groove that serves as an outer race for the balls *h* of the ball bearing and cooperates with the inner race *i* rigid with the core.

The freewheel body *c* thus described is designed so as to engage and to be fitted over the freewheel core *a*, said body bearing revolubly over the latter through the agency of the ball bearing at *i* on one hand while its axial bore provided in the part *c*1 fits over the narrow bearing surface *a*3 of the core with a slight clearance.

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A nut *j* screwed over the end of the bearing portion *a*1 of the core is locked against the race *i* of the ball bearing and holds the body *c* in position against the core *a*. The slightly greater breadth of the race *i* of the ball bearing with reference to the breadth of the part *c*2 of the body forming the other race will be remarked as this is intended to prevent the direct locking of the latter between the part *a*2 of the core and the nut *j*. A slight suitable clearance is also provided as disclosed between the bearing *a*3 on the core and the body of the freewheel surrounding it.

Of course, the freewheel includes the known arrangement comprising springs and catches housed in recesses of the part *a*2 of the core, the catches engaging the inner system of teeth *c*3 on the freewheel body so as to allow the drive of the core and hub in a single direction of rotation only.

The freewhel thus executed associates in an original manner the rolling over balls with a bearing on a smooth bearing surface. In spite of its apparent anomaly, this arrangement is of considerable advantage because:

When the core *a* of the hub is driven through the pinions, the considerable stress that is then exerted by the chain, is absorbed through two stable and distant bearing points that are on one hand the ball bearing *h* and, on the other hand, the catches of the core that abut and are locked rigidly by the system of teeth *c*3 on the free wheel body, which is very rational for the operation of the mechanism.

During operation under freewheeling conditions, only the core *a* rotates and no stress is exerted on the pinions and the body; the ball bearing *h* is then sufficient for ensuring a smooth and normal rotation which is not disturbed by the possible eccentricity of any adjacent ball bearing.

Furthermore, the freewheel according to the invention removes to a large extent the drawback of the lateral stresses that may be exerted by the chain on the freewheel when said chain is wound over the extreme pinions. Similarly, this removes the objectionable straining of the chain through deformation of the latter at the point at which it meshes with the teeth of the pinion, when its plane of unwinding is shifted.

As a matter of fact, considering the axis X as the normal axis of the chain lying in the plane of the pedal crank pinion, when the chain *k* is wound over the large extreme pinion *e* (Fig. 6) or over the smaller pinion *g* (Fig. 7), the system including the pinions and body *c* is allowed to slope slightly by an angle A so as to remain in alignment with the chain and to avoid abnormal deformation and wear. The pivoting of the system including the pinions and body *c* is performed on the balls *h* forming a rotula while benefiting by the clearance provided between the core *a* and the body *c*.

It should lastly be remarked that said freewheel does away with one ball bearing and its balls, which means a substantial economy. We improve also the ease of mounting of the freewheel and chiefly its easy dismantling that produces no dispersion of the balls.

As obvious and as already apparent from the preceding disclosure, our invention is by no means limited to the applications and embodiments of its various parts that have been more particularly disclosed; it covers, on the contrary, all the modifications thereof falling within the scope of accompanying claims.

What we claim is:

1. A freewheel carrying stepped pinions cooperating with a ball bearing and a smooth bearing surface to allow its rotation over a core with a slight clearance between it and the smooth bearing surface provided on one end of said core while it is centrally and revolubly supported by a ball bearing carried by the other end of the core that is of a reduced diameter, the usual spring, catch and tooth arrangement connecting the free wheel body with the core to ensure their synchronous rotation in the direction of driving;

2. A freewheel as claimed in claim 1 wherein the core of the freewheel shows a narrow smooth bearing surface of a larger diameter on one end and on the other end a part of reduced diameter, the end of which is threaded in order to receive a locking nut that is urged against the inner race of the ball bearing mounted on the core.

3. A freewheel as claimed i claim 1 or 2 wherein the body on which are mounted the pinions, includes a bored part of a large diameter revolving round the narrow bearing surface of the core, and a bored part of a reduced diameter that is cut inwardly and annularly to form an outer race for the ball bearing, the balls rotating between said race and the inner race fitted centrally over the corresponding end of the core.

4. A freewheel as claimed in claims 1, 2 and 3 wherein a slight play is allowed between the narrow bearing surface on the core and the body and also between the lateral surfaces of the reduced diameter part of the body and the core and associated locking nut.

5. A freewheel as claimed in claim 4 providing for a pivotal movement of the system including the body and its pinions to allow said system to remain in alignment with the plane of the chain, said pivotal movement being performed over the balls of the ball bearing acting as a rotula, advantage being

taken of the clearances referred to.

6. Freewheels for bicycles and the like vehicles and bicycles and the like mechanisms incorporating same, substantially as described with reference to and as illustrated in accompanying drawings.

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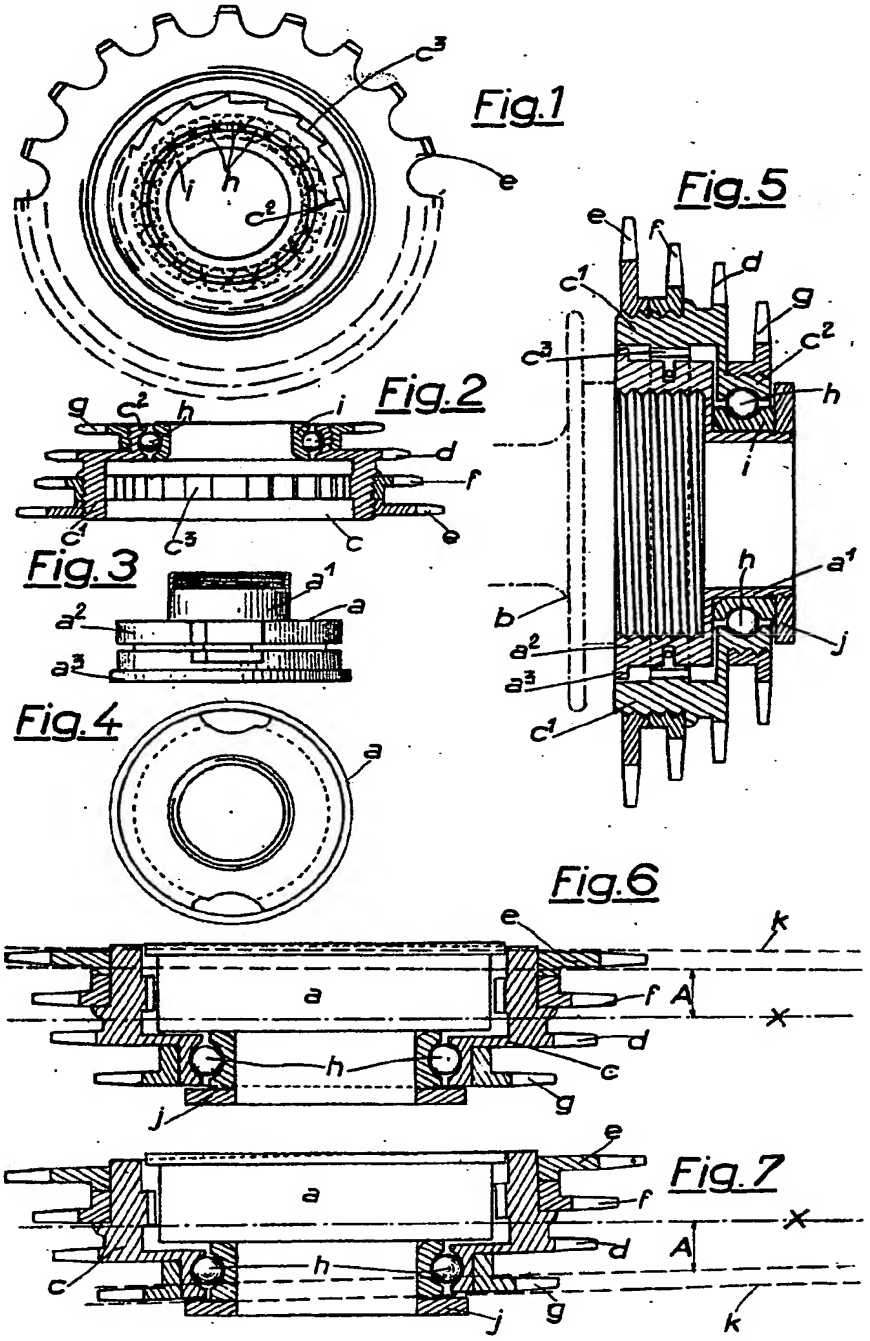
Guildford: Printed for Her Majesty's Stationery Office, by Billing and Sons, Ltd.—1952.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
from which copies may be obtained.



H.M.S.O. (M.F.P.)